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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/388,031 09/01/99 AKRAM

S 3442US (96-42

EXAMINER

MMC2/0926

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PO BOX 2550
SALT LAKE CITY UT 84110

LEE, E

ART UNIT

PAPER NUMBER

2815

DATE MAILED:

09/26/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.

09/388,031

Applicant(s)

AKRAM, SALMAN

Examiner

Eugene Lee

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 September 1999.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-28 and 100-129 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-28 and 100-129 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 June 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

2. Claims 1, 4 thru 8, 10 thru 13 and 15 are rejected under 35 U.S.C. 102(e) as being anticipated by Liu et al. '745 B1. Liu discloses (see, for example, FIG. 2D) a copper electrical interconnect comprising a semiconductor substrate 2, bottom barrier layer (metal layer) 4, copper layer (conducting layer) 6, and spacers 14. The spacers are formed from a passivating layer 12 made of Ta, TaN, TiN, etc. See column 4, lines 21-37.

a. Regarding claims 4-7, see column 3, lines 39-42 where Liu states that the barrier layer may comprise materials such as TaN, TiN, and Ta or various single or stacked combinations.

b. Regarding claim 12 and 13, see element 16 of FIG. 5 and column 5, lines 1-4.

3. Insofar as definite, claims 16 thru 28, 101, and 116 thru 129 are rejected under 35 U.S.C. 102(e) as being anticipated by Drynan et al. '682 B1. Drynan discloses (see, for example, FIG. 9B) a semiconductor device comprising a substrate, first wiring layer (metal layer) 108ac, first wiring layer (conductive line) 117, second BPSG film (dielectric layer) 122, conductive film spacer (metal spacer) 125, and first layer contact plug (conductive layer) 137.

a. Regarding claim 19 and 20, see, for example, column 20, lines 38-41.

b. Regarding claim 21 and 22, see element (silicon oxide film) 102 in FIG. 9B.

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- c. Regarding claims 17, 18, 24, 25, see column 17, lines 60-* and column 18, lines 58-* where Drynan states that the wiring may comprise titanium nitride and is a stacked film.
- d. Regarding claims 26-28, see FIG. 26B where a third wiring layer (upper metal layer) 338a is shown.

Claim Rejections - 35 USC § 103

- 4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

- 5. Claims 2, 3, 100, 102 thru 113, and 115 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. '745 B1 as applied to claims 1, 4 thru 8, 10 thru 13 and 15 above, and further in view of Cox '439. Liu does not disclose a dielectric layer on the substrate upper surface and underlying the metal layer. However, Cox discloses (see, for example, Fig. 2) a semiconductor device comprising conductive lines 54, 56, and 58 over an insulating layer 50a and substrate 50b. The insulating layer serves as a base upon which the conductive pattern is constructed. See column 5, lines 1-7. Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to include the insulating layer on the substrate of Liu in order to provide a further base for the semiconductor device
- 6. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. '745 B1. Liu discloses the claimed invention except for the conductive material as aluminum-copper

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alloy. It would have been obvious to one of having ordinary skill in the art at the time of invention was made to use a conductive material such as aluminum-copper alloy, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

7. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. '745 B1 as applied to claims 1, 4 thru 8, 10 thru 13 and 15 above, and further in view of Matsuno '502. Liu does not disclose a fluorine-doped silicon oxide. However, Matsuno teaches that dielectric films doped with fluorine provide films with low dielectric constants. See, for example, see column 1, lines 20-63. Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to add fluorine, in order to form a low dielectric film, and improve the overall speed of a semiconductor device.

8. Claim 114 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. '745 B1 in view of Cox '439 as applied to claims 2, 3, 100, 102 thru 113 and 115 above, and further in view of Matsuno '502. Liu in view of Cox does not disclose a fluorine-doped silicon oxide. However, Matsuno teaches that dielectric films doped with fluorine provide films with low dielectric constants. See, for example, see column 1, lines 20-63. Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to add fluorine, in order to form a low dielectric film, and improve the overall speed of a semiconductor device.

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Response to Arguments

9. Applicant's arguments with respect to claims 1-28, and 100-129 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a).

Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

INFORMATION ON HOW TO CONTACT THE USPTO

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eugene Lee whose telephone number is 703-305-5695. The examiner can normally be reached on M-F 8-5.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on 703-308-1690. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Eugene Lee
September 22, 2001

A handwritten signature in black ink, appearing to read 'Eddie Lee', with a large, sweeping initial 'E'.

EDDIE LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800